

NIMBUS HATCHERY FISH PASSAGE PROJECT ALTERNATIVES

Three alternatives will be evaluated in the EIS/EIR

- < No Action Alternative— Continuation of existing conditions
- < Alternative 1 — Modified fishway and removal of the fish weir
- < Alternative 2—Replacement of the diversion weir with a six-bay bypass and a denil fish ladder

The No Action Alternative continues using the diversion weir and continues the ongoing annual operations and maintenance.

Alternative 1 involves the construction of a fishway from the Nimbus Fish Hatchery to the stilling basin below Nimbus Dam and removing the existing diversion weir. Nimbus Dam functions as the upstream barrier to fish migration.

Alternative 2 involves replacing the existing diversion weir with a new diversion weir immediately upstream of the existing diversion weir. The new diversion weir would be equipped with a concrete foundation, a 6-bay bypass, and a set of air-bladder operated control gates on the bypass section. A set of air-bladder operated pickets across the entire length of the structure would be raised to block passage of fish. This alternative would add additional entrances to the ladder and continue to use the majority of the existing ladder.

NO ACTION ALTERNATIVE—CONTINUANCE OF EXISTING CONDITIONS

FACILITIES

The existing 326-foot-long diversion weir spans the American River approximately 0.25 mile downstream of the Nimbus Dam. The structure has eight vertical concrete piers located every 30 feet across the river and two riverbank abutments. The foundation between the piers consists of sheet pile, steel H-beams, and rock with a crest elevation of 77.5 feet mean sea level (msl). The entire structure is angled at about 55° from the center line of the river, with the north side of the structure further downstream. The superstructure, which must be installed and removed seasonally, includes racks, pickets, and a walkway.

A layer of 1- to 3-foot riprap and 6- to 12-inch river rock was placed in the river from the diversion weir to a location approximately 25 feet upstream as part of the foundation repairs completed in 1997. The finished elevation is about 77.5 feet msl at the diversion weir and about 70 feet msl 25 feet upstream. The thalweg of the river is approximately 65 feet msl upstream and downstream of the diversion weir.

The fish ladder, approximately 260 feet long and 9 feet wide, is made of concrete and uses a series of 1-foot drop structures, and has a gradient of 8.3%. The pools and drops are created using flashboards located about 12 feet apart. Normal operating flow in the ladder is 20-25 cfs. A manually operated pipe gate is located where the ladder enters the river to control the number of salmon that enter the ladder.

The south bank of the river is armored with riprap from the upstream side of the Hazel Avenue Bridge to a point 1,500 feet downstream of the bridge.

The parking lot at the Nimbus Fish Hatchery contains about 170 parking spaces. In addition to providing parking for visitors to the hatchery, it is also used by the public for accessing the American River Parkway bike trail, Nimbus Shoals, and the American River within the hatchery and adjacent Parkway. The hatchery parking area is also one of the sites of the Salmon Festival, a 3-day event held in October.

CONSTRUCTION ACTIVITIES

There is no new major construction activity associated with the No Action Alternative. Regular and extraordinary repairs to the weir foundation and piers requiring construction and in-river work are expected to occur in years following significant flood events (approximately once every 10 years).

OPERATIONS AND MAINTENANCE

The existing diversion weir becomes operational when the support frame and walkways are installed, the pickets (vertically aligned cylindrical steel bars) are attached and seated into the upstream bottom edge of the support frame. Sandbags are placed as needed in the larger gaps between the bottom support frame/pickets and rock foundation. Installation occurs every year in mid-September. River flows, during installation, must be in the range of 1,000 to 1,500 cfs to allow safe access to the foundation of the diversion weir. River flows must be even lower if major repairs are needed or if problems are encountered during installation. Typically flows are temporarily reduced to perform the installation. The duration of the reductions has ranged from 4 hours, under the best conditions, to 5 days, when significant flow events have scoured the foundation of the structure.

The fish ladder is opened when it is likely that water temperatures in the Nimbus Fish Hatchery can be maintained at approximately 60°F, or lower. This usually occurs in the first two weeks of November. The temperature of the water entering the hatchery is the same as that released from Nimbus Dam.

The Nimbus Fish Hatchery stops taking salmon for spawning in mid- to late-December, and the superstructure is removed in early January. Steelhead enter the fish ladder from mid-December through April without the diversion weir in place.

The weir superstructure is vulnerable to damage at flows over 5,000 cfs. The pickets must be removed if releases of 5,000 cfs are anticipated. The racks must be removed if releases of 10,000 cfs are anticipated. The walkway is removed if releases of 15,000 cfs are anticipated. The entire weir is usually completely removed rather than incrementally as the above may imply.

Historically, following high flood flows, major repairs to the diversion weir's foundation have been needed. This has included placing significant amounts of rock and cobble in voids in the foundation, which typically requires lowering the flow in the river. Damage to the ladder entrance and loss of piers has also occurred in past flood events. It is anticipated that a significant flood event (historic record indicates flows in excess of approximately 50 TAF) would continue to cause variable levels of damage that would require repair and eventual replacement of the existing weir.

Debris is cleaned from the diversion weir by hatchery personnel on a daily basis once it becomes operational. Dead salmon are removed and accounted for in annual estimates of run size. The larger and readily accessible debris is also removed and disposed of. The remainder of debris is allowed to pass downstream by raising the weir pickets then reseating in the bottom support frame.

The ladder is cleaned shortly after it is closed in the spring. Any required maintenance of the ladder and diversion weir is completed before reinstallation of the diversion weir in the fall.

Operation of the Nimbus Fish Hatchery has no effect upstream of the diversion weir to Nimbus Dam, other than the backwater effect of the weir's foundation. The area between Hazel Avenue and the dam is known as Nimbus Shoals and is open to the public from 6:00 a.m. to 9:00 p.m. during the summer season, and from 7:00 a.m. to 7:00 p.m. during the winter season.

ALTERNATIVE 1 -- MODIFIED FISHWAY

FACILITIES

The modified fishway alternative would involve the construction of a new fish passageway from the Nimbus Dam stilling basin to the hatchery and the removal of the existing weir structure. The upper-end of the fish passageway would consist of a low gradient concrete flume fishway that begins at the top of the existing fish ladder, extends along the left-bank of the American River beneath the Hazel Avenue Bridge to a point just downstream from the existing access road to Nimbus Shoals. A pool and weir ladder section will extend from end of the flume section to a point along the edge of Nimbus Shoals. This is followed by a rock lined trapezoidal channel that extends from the bottom of the ladder section to the edge of the Nimbus Dam stilling basin. A supplemental supply of water will be added at the bottom end of the ladder and at the entrance to the structure to help provide a supplemental flow needed to improve attraction to the ladder and maintain an adequate depth of flow in the rock channel section. Design flow for the flume and ladder sections are 25 cfs. Auxiliary flow is expected to provide an additional 40 cfs to the rock channel and ladder entrance.

Flume and Ladder Sections

The flume section extends for approximately 700 ft at a gradient of .028 percent at a width of 6 ft. The gradient is increased to 0.5 percent in the remaining 606 ft of the flume. The flume section will have slots to install stoplog weirs every 100 ft and capability to add additional supports and weirs if needed. The velocity through the flume is expected to be 1 ft/s. The flume section will be fenced to prevent access by the public. The invert elevation at its upstream end where the flume section connects to the existing ladder is at elevation 98.0 ft and elevation 95.45 ft at the end where it transitions into the ladder section. The ladder section will have an invert elevation of 80 ft at the downstream end and be positioned to start near the access road into the Shoal area. The gradient within the ladder section will be 8.3 percent. The top of the concrete ladder walls at the downstream end of the ladder will be at elevation 88.6 ft. The ladder section would also be covered with fencing to keep the public out.

The ladder would begin submerging once the flow depth over the Shoals exceeds El. 88.6 ft. Based upon information from the power plant tailrace with the existing weir in place, El. 88.6 ft would occur at that location under a discharge of approximately 15,000 ft³/s. The actual flow that would submerge the top of the ladder walls making the ladder non-functional will be looked at further in final design.

A bridge and roadway across the upper portion of the ladder section would be provided to allow public access to the Nimbus Shoals area. A second bridge would span the flume section between the hatchery and Hazel Avenue Bridge to provide access and egress to the lower portions of the existing ladder and river. All facilities constructed would be in conformance with the Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36).

Transition from the Rock Channel to the Ladder

The major portion of auxiliary flow will be input at the transition between the ladder and the rock channel through a diffuser with a target velocity of 1 ft/s or less through concrete walls. Keeping the velocity at or below 1 ft/s will prevent false attraction. Inputting through the wall instead of the floor will minimize sediment concerns. No specific design has been prepared at this time. A pipe gate similar to the gate on

the existing facility would be placed at the end of the ladder to control the number of fish entering the facility, as necessary.

Rock Channel

The rock channel will have a trapezoidal shape with a 4 ft bottom width and 2:1 side slopes. The rock channel will have a fairly mild slope of about 1.3 percent over about 400 ft. The drop will be about 4 ft from El. 80 ft at the entrance to the ladder down to El. 76 ft where it would enter the stilling basin at the toe of Nimbus Dam. These elevations could change some as the structures are aligned in final design if necessary for maintaining minimum water level at the entrance. The velocities in the channel will range between 1 ft/s and 2 ft/s. The water level in the channel will be controlled by a series of 6 chevron-shaped gradient control structures made of rocks or cylinders that will be imbedded in the channel to form small drops and pools.

The depth in the rock channel will probably be about 2 to 3 ft but will be maximized as much as possible given the flow and geometry constraints. The rock channel will not be covered, nor foot traffic physically restricted. The plan is to place large rock bollards around the channel to prevent vehicle access to the channel, but no fencing is planned to otherwise restrict access.

Preliminary Flow 3D simulations of the river between Nimbus Dam and the Shoal area with the baseline design have been performed. The area of high contours in the river below the power plant will control the flow and produce a riffle at low flows. Given the high elevation of the topography in this area, the rock channel will have water in it most of the year, even when not operational. Low flow rate for design of the rock channel entrance invert should be set at 250 ft³/s based upon the current operational requirements that Reclamation uses. Therefore, the invert of the rock channel entrance should be set for a minimum of 3 to 4 ft under this flow rate. The rock channel invert is currently set at El. 76 ft. Submergence of the Shoals occurs non-uniformly and is controlled by the topography. The discharge that will produce Shoal submergence and ensure adequate rock channel entrance depth will be determined by further numerical modeling using Flow 3D once final design is underway.

Auxiliary Flow

Designs for the auxiliary flow systems will be developed that introduce water at both the bottom of the ladder section and at the entrance to the rock channel section. Most of the available auxiliary water will be introduced at the top of the rock channel to produce adequate flow velocity and depth through the rock channel. Some additional flow will be added into the pool near the rock channel entrance providing jetting even a small amount of flow to assist with attraction.

Existing Weir Removal

The existing hatchery weir is not projected to be removed until after one or two seasons of use of the new structure. A design and conceptual process for removal of the weir includes; cutting off and off-site disposal of the piers, removal of all the sheet pile, wire, and rebar in the foundation and surrounding river bottom, and removal and redistribution of the large angular rock and cobble in the foundation to the finished grade of the river. It is anticipated that some spawning gravels could be placed near the bank by the existing ladder to improve habitat and interpretive opportunities in the future. Initial numerical modeling has shown that the riffle immediately downstream from Nimbus Dam will be further exposed in the river upstream under low flows.

CONSTRUCTION ACTIVITIES

Construction is expected to take place during 2 years of a 3-year period. In year 1, the new fish channel would be constructed. During year 2, the new fish channel would be operated and evaluated. The existing ladder and diversion weir would remain until the new fish channel is demonstrated to function. Satisfactory performance is expected by the third year, at which time the existing diversion weir would be removed and any modifications to the new channel would be made. There would be no seasonal restrictions for construction of the fish channel.

Construction staging would occur on a portion of the hatchery parking lot. The staging area at the hatchery would require closing a portion of the parking lot (about 65 parking spaces) from November through the following spring for construction of the channel, and from May through September for removal of the diversion weir 2 years later. Further requirements for staging on the Nimbus Dam side of Hazel Avenue needs clarification from the Design Team.

Construction equipment, including haul trucks, would cross the bike trail at the entrance to the Nimbus Fish Hatchery and the entrance to Nimbus Shoals. Bike trail traffic may also be re-routed at times during construction of the portion of the fishway immediately adjacent to Hazel Avenue. Access to the Nimbus Shoals area by vehicle and foot traffic would be restricted/controlled as needed to ensure public safety during construction of the fish channel upstream from the Hazel Avenue Bridge.

The existing parking on Nimbus Shoals is uncontrolled and would be affected during construction of the fish channel. Temporary closures during construction will occur. A bridge will provide access to the Shoals across the fish channel.

Construction activities for the concrete flume fishway would take place in a 65-foot corridor, except under the Hazel Avenue Bridge, where it would be more restricted. The area permanently and temporarily affected would vary among alternatives.

The rock and cobble foundation of the existing diversion weir would be removed from the river using heavy equipment, including track loaders, bulldozers, and excavators. A temporary construction road would provide access from the parking lot to the foundation of the diversion weir. It is assumed that heavy equipment would be driven along foundation within the river to access the northwest side of the river where a notch in the foundation between the right abutment and next closest pier would be excavated. The notch will reduce the volume of water flowing over the weir to help access to the structure and assist with sediment control during the excavation process. After the diversion weir is removed, the road would be removed, riprap would be replaced along the bank, and the disturbed area landward of the riprap would be restored. Concrete and steel remnants of the diversion weir would be disposed of off-site. The large rip-rap contained in the foundation would be removed and stockpiled for future use or re-distributed within the deeper areas immediately adjacent to the existing foundation. The area affected by removal of the diversion weir would extend about 35 feet upstream and 35 feet downstream of the diversion weir, which is approximately 0.5 acre. Removal of the existing diversion weir would be limited to May through September to protect adult salmon and steelhead and to avoid high flood releases.

A rock access berm with a plastic liner, or sheet pile, would be used to dewater the site for construction of the entrance to the fish channel. The berm, or sheet pile, would be removed to an off-site storage or disposal area after construction is complete.

OPERATIONS AND MAINTENANCE

Operations of the ladder would be the same as current conditions. The current ladder is cleaned, inspected, and repaired as needed annually. The new ladder would require some additional time by hatchery personnel to clean.

Water for the upper portion of the ladder would come from the main supply line at the hatchery at a rate of about 25 cfs. Augmentation flows would come from the 42-inch pipeline at a point located south of Hazel Avenue at a rate of up to 40 cfs.

ALTERNATIVE 2 -- REPLACEMENT OF EXISTING DIVERSION WEIR

FACILITIES

This alternative consists of a 750-foot-long, 52-foot-wide concrete weir that spans the width of the river just upstream of the existing ladder entrance. The crest of the diversion weir would be at an elevation of 79.5 feet msl. Six 15 ft wide bypass bays on the south (hatchery) side of the river would allow access to perform maintenance of the structure at flows less than 2,500 cfs. A deck at elevation 81 feet msl would be built over the bays to allow access to the remainder of the structure for maintenance. The structure would be designed to withstand flows of 160,000 cfs, which is the ultimate design capacity of the downstream levees. The base of the ladder would be modified and include 4 separate entrances that would be used in combination or alone to maximize fish entry into the ladder. The new entrances would be located to operate in flows up to 7,000 cfs. Performance would be expected to decline at higher flows.

Each bypass bay would have an air-bladder-operated gate to control the flow through the bays. The gates would be lowered when the ladder is not in use and raised to block fish when needed for hatchery operations. Pickets would extend from the top of the gates to prevent salmon from proceeding upstream when the gates are in the raised position.

A new entrance to the existing hatchery ladder would function for river flows up to 7,000 cfs. Four entrance gates would provide the ability to change the entrance position based on velocity in and immediately downstream from the bypass portion of the diversion weir. A denil fish ladder would be included to allow for the passage of juvenile salmonids upstream of the diversion weir. The entrance into the denil ladder would be located within the first bay of the ladder and have a downstream invert of 74 feet msl, an upstream invert of 78.8 feet msl, and an overall slope of 5%. It would provide for passage of juvenile salmonids when river flows are in the range of 1,000 to 2,500 cfs when the bypass is closed. When the bypass is open, the denil fish ladder would be inoperable. Water velocities in the V-section of the denil ladder would be in the range of 1 to 2 cfs.

The south bank of the river would be returned to the existing condition (armored with riprap). The rock will come from the existing bank material, the existing diversion weir foundation, and if necessary, from off-site sources.

CONSTRUCTION ACTIVITIES

Construction would take 2 years. All in river construction would be limited to May through September. During the first year, a coffer dam would be constructed in the south half of the river to allow construction of the bypass bays, fish ladder entrance, and a portion of the diversion weir. A portion of the existing diversion weir would need to be removed before constructing the entrance to the hatchery and fish passage ladders. During the second year, a coffer dam would be constructed on the north side of the river and that portion of the diversion weir completed. Access to the construction site would be across the newly constructed portion of the replacement weir. River flows would be directed through the bypass

bays as the north portion of the structure is constructed. The remaining portions of the existing diversion weir would be removed as discussed for the Modified Fishway alternative, except that the bypass gates would be closed to allow equipment to reach the existing diversion weir. This may require the temporary placement of rock downstream of the bypass; thus, the water would be shallow enough for the equipment to pass. With the bypass closed, the river would flow over the crest of the diversion weir.

3.7.3 OPERATIONS AND MAINTENANCE

The gates and pickets in the bypass bays and the pickets over the entire structure would be raised to elevation 79.5 feet msl in early September of each year. They would be lowered in late December after the hatchery stops taking salmon. This would result in water flowing over the entire crest of the diversion weir during this time. At flows exceeding 7,000 cfs, the gates would be lowered. The denil fish ladder would be open from early September until late December while the bypass is closed. It would be closed the remainder of the year. Operations and maintenance of the ladder portion of the structure would be similar to that conducted for the No Action Alternative. Annual installation of the weir would no longer occur, but maintenance of the new weir would likely be extensive given the movable parts associated with the bypass gates and pickets, hydraulic systems, and multiple ladder entrances.